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Abstract: Public intervention addressing the issue of underage marriage emphasizes policies such as girls' education and enforcement of age-of-consent laws as promising avenues for ending this harmful practice. It has been argued, however, that such policies will work better in societies where there are supported by men. Yet, there is no study analyzing the role of males' characteristics in relation to early marriage. This paper examines the causal effect of a male's education on the likelihood that he marries an underage girl. Using micro-level data from Nigeria in combination with plausible instrumental variables that address potential endogeneity issues, we find that having more years of schooling significantly reduces the probability of marrying an underage girl. Importantly, we show that this negative relationship is not a mere mechanical effect reflecting the endogeneity between schooling and marriage-timing decisions. Moreover, we find that this relationship is weaker in communities where norms that cast women in submissive roles are stronger. We develop a model that explains this causal effect as resulting from the complementarity between father's and mother's education in the production of child quality.

JEL: J12, J13, O12.

Keywords: Underage Marriage; Male Education; Nigeria; Patriarchal Norms.

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1 Introduction

Underage marriage is a global scourge that undermines the life chances of millions of girls, especially in developing countries. The United Nations Population Fund (UNFPA, 2012) estimates that one in three girls in these countries marries before the legal age of 18. In absolute terms, these are very high numbers. For example, the estimated number of underage brides is 26.6 million in India; 3.9 million in Bangladesh; and 3.3 million in Nigeria. Scholars and practitioners recognize that there exists a number of supply-side factors which provide parents with strong incentives to marry off their underage daughters (UNICEF 2005; UNFPA 2012). To counter these factors, policymakers have often emphasized supply-side policies including, for example, investment in girls' education and the prescription of age-of-consent laws for marriage. However, it is also increasingly recognized that such policies would work better in societies where they have the support of men, as prospective grooms, community leaders, or public officers (Farré, 2011). Yet there has been so far no systematic attempt to understand individual characteristics that induce males' desire for underage brides. Our analysis advances the understanding of these characteristics: it gauges the effect of a male's level of education on the likelihood that he marries an underage girl, and explores spatial sources of heterogeneity in this effect.

The key idea underlying our analysis is that educated males are more likely to want educated offspring. To the extent that marriage is entered into primarily for reproductive purposes, and paternal and maternal education are complementary in enhancing children's human capital, males with more years of schooling are also more likely to marry educated females. Casual macro-level evidence drawn from Figure 1 lends support to this idea. It shows that the proportion of underage brides is lower in countries where the average number of years of schooling completed is higher for males. Moreover, support for this conjecture is not restricted to macro-level evidence; it is also found at the individual level. Indeed, Figure 2, built using micro-level data from Nigeria–the setting of our empirical analysis–, reveals a negative association between a male's number of years of schooling completed and the likelihood that he marries an underage girl.

However, critics may argue that there is no a priori reason to believe that this negative association measures the causal effect of education on the likelihood that a male marries an underage girl. In fact, one may even argue that this negative association is a mere mechanical effect reflecting the endogeneity of a male's education and his marriage timing: a male with no schooling may marry young, and thus may end up picking an underage bride, not because he lacks education, but simply because he married early. Likewise, a male with more years of schooling may choose an older bride, not because he has more years of schooling, but because he delayed participation in the marriage market so as to focus on his education. To correctly identify the effect of a male's education therefore requires that we rule out the above-mentioned mechanical effect.

Figure 3, obtained by excluding from our sample all males married before the age of 30, provides a glimpse of the impact of controlling for this mechanical effect. It reports the proportion of married males aged 30 or higher at the time of marriage whose wives were underage, by level of education. Excluding all males married before the age of 30 allows us to restrict attention only to those whose completed level of education is more likely to be exogenous to their marriage timing. As shown in Figure 3, the strong negative association found in Figure 2 persists. This descriptive finding motivates our formal investigation of the causal effect of male education.

Ordinary least squares (OLS) estimates show that an additional year of education decreases the probability that a male marries an underage girl by more than 3 percentage points. These estimates are robust to controlling for potential confounders, including the groom's occupation, religious affiliation, region (North vs. South) and area (urban vs. rural) of residence. In addition, we control for a groom's age at marriage, and the proportion of his older co-ethnics living in his neighborhood who married underage girls. As argued above, controlling for the groom's age at marriage eliminates the possibility that the estimated effect of his level of education is driven by the above-mentioned mechanical effect. Furthermore, controlling for the proportion of older co-ethnics who married underage girls is important to rule out the confounding effect of intergenerational transmission of cultural beliefs and practices (Farré and Vella (2013); Jayachandran (2015)), which may influence the bride

choices of younger male cohorts. Despite these controls, we still find that less educated males tend to marry underage girls.

Our OLS regressions suffer from two potential endogeneity issues. First, in a context where marrying early is becoming more stigmatized, female respondents in a survey might overreport their age at first marriage. Even though, in our regressions, a female's age at marriage is not an independent variable, error in its measurement may yet lead to an attenuation bias, given that females most likely to misreport their age at first marriage are those married to less educated males. Second, a male's ability is likely to determine simultaneously his level of education and the age of his bride at marriage. Since ability is unobserved in our dataset, this likely creates an omitted variable bias. Indeed, if ability positively affects education and negatively affects the probability of marrying an underage girl, then not controlling for this variable may lead to another downward bias.

For identification therefore, we propose two instruments for male education. The first instrument is the average level of education of a male's older male co-ethnics (5 years older or higher) living in the same neighborhood. The validity of the first stage regression relies on the theory of human capital externalities according to which the level of education of older cohorts has a positive effect on the education of younger cohorts (e.g., Borjas (1992), Wantchekon et al. (2015), and Dev et al. (2016)). Moreover, even though, as for younger males, the education of older males might be determined by the same unobservables, this does not compromise the validity of the first stage regression, which only requires that the instrument and the regressor of interest be correlated. However, for the exclusion restriction condition, the use of this instrument raises a potential issue: if older male co-ethnics themselves married underage girls, they may use ethnic tradition and/or culture to directly affect the probability that younger male co-ethnics marry underage girls–the dependent variable of interest. One reason for them to act in this way, and which is supported by the literature, is that they may have a vested interest in the intergenerational transmission of patriarchal gender norms that cast females in submissive roles relative to males (Farré and Vella (2013); Jayachandran (2015)). In order to ensure that this instrument satisfies the exclusion restriction condition, we directly control for the proportion of male co-ethnics whose brides

were underage at the time of marriage. Indeed, any potential unobserved mechanism that induces a direct effect of the education of older male co-ethnics on the type of bride chosen by their younger counterparts should also determine the type of bride chosen by members of the older cohorts. The proportion of older male co-ethnics who married underage girls can therefore be viewed as a proxy for such a mechanism, and controlling for it effectively nullifies any potential direct effect of the instrument on marriage decisions in the younger cohorts.

The second instrument is the average level of education of older male cohorts (5 years older or higher) from other ethnic groups living in the same neighborhood. As in the case of the first instrument, the validity of the first stage regression is supported by the theory of human capital externality (Dev et al., 2016). Indeed, Dev et al. (2016) show that human capital externalities flowing from older cohorts to younger ones, though stronger within a given ethnic network, also extend to younger cohorts outside this network. Importantly, the second instrument, unlike the first, is unlikely to have a direct effect on the dependent variable in our setting. The reason is that in most ethnically divided societies, including Nigeria (Dev et al., 2016), individuals are primarily accountable to their own ethnic group for the life choices they make.

Consistent with the above discussion, we follow a two-step strategy for applying our IV approach. First, we use each IV separately in our estimations, then use them simultaneously. Compared to OLS estimates, and for each IV, we find a stronger negative relationship between a male's level of education and the likelihood that he marries an underage girl. This finding confirms, as argued above, that OLS, in our setting, suffers from an attenuation bias.

We also perform a number of robustness checks and sensitivity analyses to rule out the operation of a possible mechanical effect, and to account for sources of heterogeneity in the effect of male education. First, we estimate the effect of a male's education on the probability that he marries an underage girl by restricting our sample to only males aged 30 or higher at the time of marriage. For this sub-sample, we find that the negative effect of a male education is stronger than the effect obtained using the larger sample, for both the OLS and the IV estimations.

Second, we estimate the effect of schooling on the probability that a male marries an underage girl, by distinguishing between the northern and southern regions of Nigeria, and between urban and rural areas. What motivates this sensitivity analysis is the possibility of regional heterogeneity in the relative strength of the process of intergenerational transmission of cultural beliefs and practices that may influence the type of bride that males choose to have. Since norms and customs tend to be more binding in close-knit communities such as ethnic groups, castes (Akerlof, 1976), and rural areas, it is important to investigate the potential implications of this source of heterogeneity for the effect of male education. For example, our data show that underage marriage is more prevalent in Northern, than in Southern, Nigeria, and in rural, than in urban, areas. More surprisingly, even among males with a tertiary education, the proportion of those married to underage girls is a whopping 50% in Northern Nigeria compared to only 10.6% in Southern Nigeria, and 49.5% in rural areas compared to only 22.9% in urban areas. This suggests that the effect of intergenerational transmission of cultural beliefs and practices is stronger in some areas of Nigeria than in others. Our IV estimates indeed show a stronger effect of male education in the South than in the North, and in urban, than in rural, areas.

Motivated by this causal negative effect of male education, we develop a simple model to uncover the theoretical mechanism underlying it. This model highlights the interplay between the quantity-quality trade-off underlying parental investment in offspring and the strategic complementarity between mother's and father's education in the production of child quality as the key channel. We provide empirical evidence supporting this mechanism. More precisely, we test for the interactions between the strategic complementarity of father's and mother's education and the quantity-quality trade-off. We effectively find that the interacting effect of the father's and mother's education is negative for the number of children they have, and positive for the level of education of these children. These results are corroborated by an additional analysis showing that the interacting effect of a groom's level of education with whether his bride was underage at the time of marriage or not is negative for the number of children they have and positive for the quality of these children.

This study contributes to the broader literature linking the social outcomes of girls and

women to their interactions with men as fathers and husbands. Jacoby and Mansuri (2010) find evidence that, while not a first-best solution, the Watta Satta traditional marriage institution in rural Pakistan, which consists of bartering a bride for a bride between two families, was an effective protection for married women against domestic violence. Ashraf et al. (2014) provide evidence from Zambia that females' adoption of contraceptives is constrained by males' attitude and behaviors. Field and Ambrus (2008) and Duflo et al. (2015) highlight underage marriage as a major constraint to female education. We build around this literature by exploring factors that may alter prospective grooms' attitudes toward underage brides.

The remainder of the paper is organized as follows. Section 2 describes the data and outlines our empirical strategy. Section 3 presents estimation results. Section 4 presents a theoretical model that explains the mechanism underpinning the negative association between a male's level of schooling and the age of his bride at marriage. Section 5 provides empirical evidence supporting this mechanism. Section 6 concludes the paper.

2 Data and Empirical Strategy

This section describes the data we use to analyze the causal effect of schooling on the likelihood that a male marries an underage girl. It also outlines our empirical strategy.

2.1 Data Description

To examine the causal relationship between a male's level of education and the likelihood that he marries an underage girl, we use the 2013 Demographic and Health Surveys (DHS) data from Nigeria. We analyze a sample of 8,658 couples (married or living together male and female). The choice of Nigeria as the setting of our empirical analysis is appropriate because, with a proportion of 43% of girls who married early, this country ranks 13th in the World among countries with the highest proportion of women aged $20-24$ who married before age 18 –the legal age for marriage consent. In absolute terms, this represents $3,306,000$

women, ranking Nigeria 3rd in the World, behind India with 26,610,000 women affected, and Bangladesh with 3,931,000[1].

We use the Couple's Recode (CR) dataset. The Couple Recode dataset contains information on pairs of individuals (male and female) who are either married or are cohabiting in a union. Information is collected on their demographic and socioeconomic characteristics. We also have information on the age at first marriage. We use this information to define a dummy variable equal to 1 if a female married before the age of 18 and 0 otherwise. Therefore, a couple is considered to have experienced underage marriage if the female partner was younger than 18 years of age at the time the couple was formed. The outcome variable we analyze is the couple's underage marriage status. Our main independent variable is the husband's level of education.

Nigeria displays large significant cross-regional disparities both in the average number of years of schooling completed by males and in the prevalence of underage marriage (Figure 4). The North-West region is the most affected by underage marriage, and is also the region where the average number of years of schooling completed is lowest among males. The South-East and the South-South regions are the least affected (11% and 18%, respectively) and are also characterized by higher levels of schooling among males (8.2 and 9.8 on average, respectively) Table 1 presents summary statistics. We note that over 59% of females in our sample were married before the age of 18. This figure is larger than the one provided by UNICEF (43%) because UNICEF is only concerned with women in the age group of 20-24.

2.2 Identification Strategies

We use two identification strategies. First, we rely on a baseline strategy that uses least squares regressions. Then we resort to the instrumental variables approach as a second identification strategy. We complement the analysis with a series of sensitivity analyses and robustness checks to account for regional heterogeneity as well as to control for a potential mechanical effect which may govern the association between a male's level education and

[1]UNICEF, State of the World's Children, 2016.

the likelihood that he marries an underage girl.

2.2.1 OLS Estimation

We start by estimating the following linear probability model (LPM) over the sample of Nigerian males married to females aged 15 - 49.

$$y_i = \beta_0 + \beta_1 E_i + \beta_2 X_i + \epsilon_i \tag{1}$$

where y_i is individual i's bride type (equal 1 if individual i's wife was under 18 at marriage, and 0 otherwise), E_i is the number of years of education attained by individual i, and X_i is a vector which includes the following controls: male i's age at first marriage, his religious affiliation, professional occupation, a dummy variable indicating whether he resides in the North or in the South, a dummy variable indicating whether his place of residence is rural or urban, and the sex ratio to capture the effect of the relative supply of brides. The sex ratio is computed by five-year age groups (e.g., 15-19, 20-24, etc.). [2] We estimate heteroskedasticity robust standard errors when estimating the model to deal with the potential clustering of observations at the neighborhood level.

2.2.2 IV Estimation

As acknowledged in the introductory section, our baseline regressions have potential endogeneity issues. The main challenges confronting the identification of the causal effect of schooling on the likelihood that a male marries an underage girl are the potential issues of measurement errors, omitted variables bias, and joint determination. To resolve these potential endogeneity issues, we use the instrumental variables approach. This method involves estimating a two-stage model in which the second stage consists of estimating equation (1),

[2] Several studies have established a link between the sex ratio and marriage opportunities for males and females (see, e.g., Angrist (2002); Pongou and Serrano (2016)). The sex ratio may also affect a male's education through several channels, including by inducing males to invest more time in courtship than in their education.

while the first stage consists of estimating the following equation:

$$E_i = \alpha_0 + \alpha_1 Z_i + \alpha_2 X_i + \nu_i \tag{2}$$

In equation (2), Z_i is the vector of instruments, X_i is the vector of control variables as in equation (1).

We instrument a male's level of education with two different variables. One is the average level of education of older male co-ethnics (5 years older or higher) and the other, the average level of education of older male cohorts (5 years older or higher) from other ethnic groups living in the same neighborhood. Our interest in each of these two instruments can be justified based on human capital externalities flowing from older, to younger, cohorts (e.g., Borjas (1992), Wantchekon et al. (2015), and Dev et al. (2016)). The presence of these externalities underlies the validity of the first-stage regressions. However, a potential issue with the first instrument for exclusion restrictions is that, just like in the case of the younger cohort, the level of education of an older male co-ethnic may be correlated with his own choice of bride's type (underage vs. legal age). If so, then this opens up a channel through which older male co-ethnics can influence the bride choices of their younger male counterparts. In other words, if older male co-ethnics are uneducated and married underage girls, they may transmit this marital practice to younger male cohorts, through tradition and culture. In order to assuage this issue, we control for the proportion of older male co-ethnics who married underage girls. Indeed, if there exists any unobserved mechanism through which the education of older male co-ethnics directly affects the type of bride chosen by their younger counterparts, this mechanism should also determine the type of bride chosen by members of the older cohorts. It follows that the proportion of older male co-ethnics who married underage girls is a proxy for such a mechanism, which is why controlling for it nullifies any potential direct effect of the instrument on marriage decisions in the younger cohorts.

Unlike the first instrument, the second is unlikely to have a direct effect on the dependent variable in our setting. Indeed, given the well-documented realities of ethnically divided societies (Horowitz, 1985) where individuals are primarily accountable to their co-ethnics for

the life choices they make, there is no clear normative mechanism through which older male cohorts from one ethnic group can influence the type of bride that younger males from other ethnic groups can choose.

We estimate the causal effect of schooling on the likelihood that a male marries an underage girl using each instrument separately, then using them simultaneously. This effect is estimated using two-stage least squares (2SLS). To provide additional evidence for the validity of our instrumental variable strategy, we undertake three statistical tests: (i) the *Hausman* exogeneity test to test the null hypothesis of exogeneity of the males' level of education in the demand for underage brides equation; (ii) the *Sargan* test for overidentification of the two instruments when we use them simultaneously; and (iii) the *Stock-Yogo* test, which tests weak identification.

3 Estimation Results

In this section, we report our estimates contrasting baseline estimates with those obtained using the instrumental variables approach.

3.1 OLS Estimates

We first report the OLS estimates of Equation (1). These estimates are presented in Table 2. Column (I) controls only for male education. It shows that each additional year of schooling for a male reduces the probability that he marries an underage girl by 3 percentage points. Column (II) controls for a male's religious affiliation, region of residence (North vs. South) and area of residence (rural vs. urban). This causes the figure reported in Column (I) to fall by roughly half, but the effect remains statistically significant. In addition, we find that being affiliated with the Muslim faith increases the probability of marrying an underage girl by 18 percentage points in comparison to other religious affiliations. We also find that living in the northern region of Nigeria increases this probability by 20 percentage points, while living in the rural area increases it by 12 percentage points.

Column (III), in addition to controlling for variables in Column (II), controls for the influence of the proportion of older co-ethnics who married underage girls on the younger cohorts bride choice. We find that an additional point increase in the proportion of older co-ethnics who married underage girls is associated with an increase in the probability that a male marries an underage girl by 38 percentage points. This result suggests the operation of a process of intergenerational transmission of cultural beliefs and practices governing males' preferences over bride types (underage vs. legal age). However, we do not find that controlling for that variable significantly affects the coefficient on male education. This implies that the above-mentioned mechanical effect we were concerned about is minimal in our setting, which is reassuring.

In addition to controlling for variables in Column (III), Column (IV) controls for the current age of a male, as well as his age at first marriage. Results indicate that each additional year of delay in marrying is associated with a decrease in the probability that a male marries an underage girl by 2 percentage points. We also uncover a slow decline in the practice of underage marriage from one generation of males to the next. Indeed, we find that increasing a male's age by one additional year is associated with an increase in the probability that he marries an underage girl by 0.3 percentage points.

Finally, Column (V) controls for the sex ratio, a proxy of the supply of brides in the community, and for males' professional activities. We find that an additional percentage point increase in the male/female sex ratio is associated with an increase in the probability that a male marries an underage girl by 1.6 percentage points, but this effect is not statistically significant. We also find that being a skilled worker or a professional worker has a negative effect on the probability that a male marries an underage girl. However, these effects are not statistically significant.

3.2 IV Estimates

The IV estimates are presented in Table 3. In Column (I) the instrument for male education is the average level of education of older male cohorts (5 years older or more) from other ethnic

groups living in the same neighbourhood. We find that each additional year of schooling a male decreases the probability that he marries an underage girl by 0.038, which is close to the OLS estimate of 0.03 when no other variable is controlled. This figure falls to 0.026 when we instrument male education by average level of education of older male co-ethnics (5 years older or more) living in the same neighborhood (Column II)[3]. In Column (III), we use both instruments simultaneously. We find that each additional year of schooling for a male causes the probability that he marries an underage girl to decrease by 0.035.

To examine the validity of the instruments, we undertake three statistical tests. First, we test the null hypothesis that male education is exogenous. The Hausman test indicates that we can consider male education as an endogeneous variable and therefore we should deal with the identification issue. Second, we perform the Sargan-Hansen test for overidenfication when we use both instruments. The test indicates that the instruments are valid. Third, we perform the Stock-Yogo test, which tests weak identification of instruments. The weak instrument problem arises when the correlation between the endogenous regressor and the set of instrumental variables is weak. We reject the null hypothesis of weak identification in all three specifications of the test. All these tests reassure that the estimated effect of a male's education on the likelihood that he marries an underage girl is causal.

3.3 Sensitivity Analyses and Robustness Checks

In this section, we conduct several sensitivity analyses and robustness checks for the effect of male education on underage marriage. We estimate this effect for males who got married at the age of 30 or higher. We also estimate this effect separately for the urban, and rural, area, and for Southern, and Northern, Nigeria.

[3]Notice that the sample size is smaller in Column (I) than in Column (II). This is due to the fact that observations from ethnically homogeneous clusters are dropped from the analysis in Column (I), since the instrument cannot be computed for those observations.

3.3.1 Males Married at 30 or Higher

To control for a potential mechanical effect which may govern the association between a male's level of education and the probability that he marries an underage girl, we restrict our sample to males aged 30 or higher at the time of the marriage. By focusing on males who married at 30 or higher, we virtually eliminate the mechanical effect whereby a less educated male marries younger than his more educated counterpart, and for this reason, may be more likely than his more educated counterpart to marry an underage girl. As shown in Table 5, a male's level of education still has a significant effect on his probability of marrying an underage girl in both OLS and IV estimations. This also confirms that the estimated effect of education on the probability that a male marries an underage girl is not a mere mechanical effect.

3.3.2 Urban versus Rural and North versus South

As discussed in the Introduction, a male's attitude towards underage marriage may be related to characteristics other than his own educational attainment. For example, as gender norms may be more binding in close-knit communities such as rural communities, residing in the city as opposed to a rural area may impact a male's attitude toward underage marriage. Figure 5 confirms these regional differences. It shows that, at all levels of male education, the likelihood of marrying an underage girl is larger in the North than in the South (Panel (a)), and in rural areas than in urban areas (Panel (b)). It also shows that the effect of male education on underage marriage is stronger in urban areas as well as in the South.

In order to confirm this heterogeneous effect, we estimate it for each region using both OLS and IV regressions. The results are presented in Table 6. The top panel shows the OLS results for both the North and the South, and the bottom panel shows the IV results. The estimates in Column (I) from the top panel, which do not include any control, show that each additional year of schooling causes the probability that a male marries an underage girl to decrease by 2.5 percentage points in the North and by 2 percentage points in the South. When we control for all potential confounders in Column (III), we find that this causal effect

is slightly stronger in the North.

When we use both instruments simultaneously (last column of the bottom panel), we find that an additional year of schooling for a male decreases the probability that he marries an underage girl by 2.6 percentage points in the North. For the South, the corresponding figure is much higher at 5.1 percentage points. These results suggest that the effect of a male's education on his probability of marrying an underage girl is much larger in the South than in the North.

Table 7 presents separate results for urban and rural areas. The top panel shows the OLS results and the bottom panel shows the IV results. The estimates in Column (I) from the top panel, where no other control is included, show that each additional year of schooling decreases the probability that a male marries an underage girl by 2.6 percentage points in urban and 2.8 percentage points in rural areas. When we control for all potential confounders in Column (III), we find that these effects decrease to 0.8 and 1 percentage points, respectively, but remains statistically significant. In the bottom panel, we observe that, in all three IV specifications, the estimates of the effect of a male's education on his probability of marrying an underage girl is negative and statistically significant in both areas, but is larger is urban areas.

4 A Model of Bride Choice

The evidence in the previous section suggests that a male's level of education negatively affects the probability that he marries an underage girl. In this section, we develop a simple model of a prospective groom's decision on the age of his bride at marriage to explain this causal relationship. In this environment, marriage is entered into for the sole purpose of reproduction. This assumption is supported by empirical evidence in the context of sub-Saharan Africa (e.g., Thomas et al. (1991); Leigh and Gong (2010)). Prospective brides are differentiated by their age θ. One can therefore think of the lower bound of θ as corresponding to the age at first menarche, and the upper bound, to the normal age at menopause. To keep the focus on the link between a groom's level of education and the age of his bride at

marriage, assume for simplicity that for each age θ there is an infinite number of brides, so that no prospective groom faces celibacy irrespective of his preferred bride's age at marriage. There is a measure one of prospective groom. Each prospective groom is characterized by his exogenously given characteristics, (e, ω), describing his level of education, e, and pre-marital income , ω.[4]

4.1 The Reproductive Surplus

A prospective groom forms a household when his marriage post is picked up by a prospective bride of his desired age, θ. Once the couple is formed, childbearing begins, yielding a reproductive surplus, ϕ, to the couple. There are several ways to think about this reproductive surplus. One way is as the joy and pride of maintaining a family lineage. Supporting this view is the evidence that in many African cultures, marriage and procreation are intertwined and inseparable, because children are considered a source of power and pride, and an assurance of family continuity (Dyer et al., 2004). An alternative way of interpreting this reproductive surplus is as old-age support from grown up children to their parents (Hoddinott (1992); Oliveira (2016); Lambert and Rossi (2016)).

For simplicity, assume that all children born to a married couple survive childhood to generate a reproductive surplus to their parents. There are no out-of-wedlock childbearing, so that the only way a prospective groom can earn a reproductive surplus is by getting married.

For each married couple, the reproductive surplus is a Cobb-Douglas function of the quantity, n, and quality, q, of their children:

$$\phi = (q)^{\gamma} (n)^{1-\gamma}, \tag{3}$$

where $\gamma \in (0, 1)$ captures the contribution of child quality to the reproductive surplus. As in Becker et al. (1990), $\gamma < 1/2$ means prospective grooms prefer quantity to quality, and

[4]In the empirical analysis above, we assume that occupation is a proxy for pre-marital income, since we do not have data on pre-marital income. This assumption is pertinent in most African societies where most men complete their education and find a job before getting married.

$\gamma > 1/2$ means the reverse.

A child's quality is influenced by participation in formal schooling—an activity whose productivity level depends on parents' ability to create a home environment that stimulates their children's cognitive development. More formally, a child's quality is given by:

$$q := 1 + \varphi(\theta, e)\, s, \tag{4}$$

where s denotes the child's level of schooling, and $\varphi(\theta, e)$, a factor capturing the effect of a child's home environment on the productivity of schooling, and which itself depends on maternal education as proxied by maternal age at marriage, θ, and paternal education, e. Our assumption that a bride's age at marriage is a proxy for her level of education draws from empirical evidence showing lower levels of education among underage brides than among their legal-age counterparts (Field and Ambrus (2008); UNICEF (2014)). Further, our own computations using 2013 DHS data for Nigeria show that among married women aged 15 - 49, those married before their 18th birthday have on average 2.7 years of schooling compared to 8.31 years of schooling on average for those married at 18 or higher. By choosing the age of his bride therefore, a prospective groom indirectly also chooses her level of education as well.

Expression (20) implies that schooling and a stimulating home environment are complementary in the production of child quality, so that a child with no schooling has a level of quality normalized to unity. We also make the following assumption:

Assumption 1. The function φ has the following property:

$$\begin{array}{lrcll} (i) & \varphi_j & > & 0, & j = \theta, e \\ (ii) & \varphi_{jj} & \leq & 0, & j = \theta, e \\ (iii) & \varphi_{jl} & > & 0, & j, l = \theta, e. \end{array}$$

Assumption 1 reflects empirical findings showing that the quality of parenting affects a child's success in school (Herbers et al. (2011)); and that parents' education is the channel

through which parenting influences a child's school success (Serafino and Tonkin (2014)). In particular, property (i) of Assumption 1 states that maternal education and parental education are essential inputs in the production of child quality; property (ii) states that the level of productivity of each parent's input is non-increasing in the level of the input; finally property (iii) states that paternal and maternal education are complementary in the production of child quality. In other words, the effect of increasing the level of paternal education on the productivity of child schooling is higher, the higher the level of maternal education. We argue that the strategic complementary between paternal and maternal education in the production of child quality along with the well-known quantity-quality trade-off in parental choice of quantity and quality of offspring forms the mechanism that governs the effect of a groom's education on the probability that he marries an underage girl.

4.2 Preferences and Budget Constraint

Each prospective groom has preferences over his own consumption of a numeraire, c, and over the household's reproductive surplus, ϕ, conditional upon being married. We assume that these preferences are represented by a log-linear utility function:

$$V_a = \log c + \beta \log \phi \tag{5}$$

where β is the relative utility weight placed upon the reproductive surplus.

Each prospective groom makes the decisions on the age of his bride at marriage, θ, his own consumption, c, the number of offspring, n, and child's level of schooling, s. It costs κs units of the numeraire to provide a child with a level of schooling s, where $\kappa > 0$ denotes the exogenously given per unit cost of education. Like child schooling, child bearing is a costly activity. The per child cost of childbearing is $\psi(\theta)$, and depends on the age of the bride at marriage.

Assumption 2. The function ψ has the following property: $\psi' > 0$.

Assumption 2 states that the per child cost of childbearing is increasing with the mother's age at marriage. This property reflects the fact that the opportunity cost of childbearing rises with the bride's age at first marriage. Indeed, older brides may command higher labor market wages, particularly if age at marriage reflects the bride's level of education. This in turn raises the opportunity cost of an activity that is taxing on a female labor time, and thus may induce a higher compensation from her husband. Indeed, one can interpret $\psi(\theta)$ as the per child compensating payment from the groom to his bride.

The budget constraint faced by a groom with level of income ω is

$$c + [\psi(\theta) + \kappa s] n \leq \omega. \tag{6}$$

The above formulation of the budget constraint implies that all costs related to children are born by the father, and children's consumption levels are normalized to 0.

A prospective groom's problem thus can be construed as a two-stage sequential choice problem written as follows, making use of the utility function in (5), the reproductive surplus in (3), (20), and the budget constraint in (6):

$$\max_{\theta} \left\{ \max_{\langle s,n \rangle} V(\theta, n, s) \right\} \tag{7}$$

where

$$V(\theta, n, s) := \log(\omega - [\psi(\theta) + \kappa s] n) + \beta\gamma \log[1 + \varphi(\theta, e) s] + \beta(1 - \gamma) \log n \tag{8}$$

denotes the value of a prospective groom with socioeconomic characteristics, (e, ω), and who makes the sequential decision, $\langle \theta, n, s \rangle$. The timing of the resolution of this sequential problem is as follows. The prospective groom first chooses the age at marriage of his bride, θ. Then, marriage takes place, and immediately the groom decides on (n, s), so as to maximize the value of getting married. Each prospective groom is forward-looking, and thus chooses his bride's age at marriage, by anticipating the effect this choice will have on his desired quantity and quality of offspring, as determined by (n, s). Hence we apply a backward

induction process to the solution to this sequential decision problem.

4.2.1 Optimal Child Quantity and Quality

We relate a prospective groom desired fertility, n, and child quality, q, to his socioeconomic characteristics, (e, ω), and the age of his bride at marriage, θ. But before we proceed with the characterization of the solution to this second stage decision problem, we make the following additional assumptions.

We draw on Assumptions 1- 2 to characterize the solution to the second-stage problem. Indeed, using (3), it can be shown that given the age of the bride he selected, θ, a prospective groom with socioeconomic characteristics, (e, ω), has optimal quantity and quality of offspring given by:

$$n = \frac{\beta (1 - 2\gamma) \varphi (\theta, e) \omega}{[1 + \beta (1 - \gamma)] [\varphi (\theta, e) \psi (\theta) - \kappa]} \equiv N (\theta, e, \omega) \tag{9}$$

$$q = \frac{\gamma}{(1 - 2\gamma) \kappa} [\varphi (\theta, e) \psi (\theta) - \kappa] \equiv Q (\theta, e, \omega) . \tag{10}$$

It follows from (9) that unless all prospective grooms prefer quantity to quality of offspring, i.e.,

$$\gamma < 1/2, \tag{11}$$

none of them will desire children, and thus none of them will gain from marriage. This fact underlies the quantity-quality trade-off analysis due to Becker and Lewis (1973). In other words, in order to desire children, parents have to put a bigger preference weigh on quantity relative to quality. Likewise, one can also see from inspection of (10) that unless the value of the marginal productivity of schooling exceeds the relative cost of schooling, i.e.,

$$\varphi (\theta, e) > \frac{\kappa}{\psi (\theta)}, \tag{12}$$

no groom will invest in child quality. Condition (12) implies that for all parents, the value of the marginal productivity of schooling exceeds its costs. In other words, for all parents, marginal returns to child schooling are large. This fact is in line with Card (2001) who finds that returns to schooling tend to be relatively high even among the low-education subgroups. We thus obtain the following results from partial differentiation of (9) and (10) respectively:

Claim 4.1 *Under Assumptions 1-2, the following statements are all true, if and only if (11) and (12) simultaneously hold:*
(i) The number of children born to a married couple is decreasing in the bride's age at marriage $(\partial N/\partial\theta < 0)$*;*
(ii) it is also decreasing in the groom's level of education $(\partial N/\partial e < 0)$*;*
(iii) but it tends to rise with the groom's income $(\partial N/\partial\omega > 0)$*.*

This claim basically implies that a marital match between a less educated male and an underage girl is characterized by a higher number of children than one involving a highly educated male and/or an older bride. It implies that a high desired fertility may be what attract less educated males towards underage girls as brides. This result reflects the interplay between the usual quantity-quality trade-off (Becker and Lewis (1973); Oliveira (2016)) and the fact that compared to an older bride, a younger bride induces a lower marginal productivity of schooling for offspring (Marteleto and Dondero (2013)), and a lower cost of childbearing which tips the balance in favor of quantity, at the expense of quality.

Claim 4.2 *Under Assumptions 1-2, the following statements are all true, if and only if (11) and (12) simultaneously hold:*
(i) The level of educational attainment of children born to a married couple is increasing in the bride's age at marriage $(\partial Q/\partial\theta > 0)$*;*
(ii) it is also increasing in the groom's level of education $(\partial Q/\partial e > 0)$*.*

Just like Claim 4.1 above, Claim 4.2, reflects the interplay between the quantity-quality trade-off and the fact that compared to an older bride, a younger bride induces a lower marginal productivity of schooling for offspring, and a lower cost of child bearing, thus reducing the return to investment in child quality relative to quantity. It suggests that a

couple in which the groom is less educated and the bride younger faces a higher opportunity cost of investment in child quality than one in which the groom is more educated and/or the bride is older.

4.3 Male Education and Bride's Age

In our discussion of the determinants of a household's reproductive surplus, we highlighted the link between the groom's socioeconomic characteristics, (e, ω), and the quantity and quality of offspring he desires. Our next step is to characterize the direct effect of a groom's education on his bride's age at marriage. Keep in mind, however, that we are not claiming that a groom's education is the only or most important cause of underage marriage. In fact, supply factors, as empirical evidence shows, also have an important role to play. The questions we have in mind are the following: if a male had a choice between an underage bride and a legal-age bride, which one would he choose? And does his level of education matter for this choice? The purpose of our theoretical framework thus is to derive the exogenous total effect of a male's level of education on the age of his bride at marriage, highlighting the mechanism underlying this effect.

To get us started in this discussion, we must first characterize the value of a groom as a function of his bride's age at marriage, θ. From (8), it holds that this value is given by

$$\begin{aligned} V(\theta, e, \omega) := & \log\left[\omega - \left[\psi(\theta) + \kappa S(\theta, e, \omega)\right] N(\theta, e, \omega)\right] \\ & + \beta\gamma \log Q(\theta, e, \omega) + \beta(1-\gamma) \log N(\theta, e, \omega) \end{aligned} \tag{13}$$

where

$$S(\theta, e, \omega) := \frac{\gamma\left[\varphi(\theta, e)\psi(\theta) - (1-\gamma)\kappa\right]}{(1-2\gamma)\kappa\varphi(\theta, e)} \tag{14}$$

denotes the optimal level of investment in child quality for a couple with characteristics

(θ, e, ω). A prospective groom's first-stage problem thus is to solve:

$$\max_{\theta} V(\theta, e, \omega)$$

By the application of the *envelope theorem*, it holds that the first-order condition for a maximum reduces to:

$$F(\theta, e, \hat{s}) := -\frac{\varphi(\theta, e)\psi'(\theta)}{\kappa} + \frac{\partial \varphi}{\partial \theta}\hat{s} = 0 \tag{15}$$

where $\hat{s} := S(\theta, e, \omega)$.

The second order condition therefore is

$$\frac{\partial F}{\partial \theta} = -\frac{1}{\kappa}\left[\varphi(\theta, e)\psi''(\theta) + \frac{\partial \varphi}{\partial \theta}\psi'(\theta)\right] + \frac{\partial^2 \varphi}{\partial \theta \partial \theta}\hat{s} + \frac{\partial \varphi}{\partial \theta}\frac{\partial \hat{s}}{\partial \theta}$$

which must be negative for a maximum to exist. Furthermore

$$\frac{\partial F}{\partial e} = \frac{\partial^2 \varphi}{\partial \theta \partial e}\hat{s} - \frac{\psi'(\theta)}{\kappa}\frac{\partial \varphi}{\partial e} + \frac{\partial \varphi}{\partial \theta}\frac{\partial \hat{s}}{\partial e} \tag{16}$$

If we denote as $\theta^* := \Theta(e)$, the solution to the first-order condition in (15), then it holds that:

$$F[\Theta(e), e] \equiv 0.$$

Totally differentiating the above identity, we then obtain the exogenous total effect of a groom's level of education on the age of his bride at marriage as follows:

$$d\theta^* = -\frac{F_e}{F_\theta}de,$$

where $F_j := \partial F/\partial j$, $j = e, \theta$. From (16), it follows that this total effect can be decomposed

into two different parts representing the direct and the indirect effect respectively:

$$d\theta^* = -\frac{1}{F_\theta}\left[\frac{\partial^2\varphi}{\partial\theta\partial e}\hat{s} - \frac{\psi'(\theta)}{\kappa}\frac{\partial\varphi}{\partial e}\right]de - \frac{\partial\varphi}{\partial\theta}\frac{\partial\hat{s}}{\partial e}\frac{de}{F_\theta}. \tag{17}$$

The indirect effect,

$$-\frac{\partial\varphi}{\partial\theta}\frac{\partial\hat{s}}{\partial e}\frac{de}{F_\theta}$$

works through the effect of paternal education on the couple's level of investment in child schooling, $\hat{s} := S(\theta, e, \omega)$. Since $-1/F_\theta$ is strictly positive, as are both $\partial\varphi/\partial\theta$ and $\partial\hat{s}/\partial e$, this indirect effect is unambiguously positive.

The direct effect,

$$-\frac{1}{F_\theta}\left[\frac{\partial^2\varphi}{\partial\theta\partial e}\hat{s} - \frac{\psi'(\theta)}{\kappa}\frac{\partial\varphi}{\partial e}\right]de,$$

has an ambiguous sign, which depends on the degree of complementarity between maternal and paternal education in the production of child quality, as measured by the cross-partial derivative $\partial^2\varphi/\partial\theta\partial e$. Observe, for example, that if

$$\frac{\partial^2\varphi}{\partial\theta\partial e} \leq 0,$$

then this direct effect is negative. A necessary, but not sufficient, condition for this direct effect to be positive is that

$$\frac{\partial^2\varphi}{\partial\theta\partial e} > 0,$$

as imposed in Assumption 2 above. In other words, using (14) above, we have:

Proposition 4.1 *Let Assumptions 1-2 hold, along with (11) and (12). If*

$$\frac{\partial^2\varphi}{\partial\theta\partial e} > \frac{(1-2\gamma)\,\varphi(\theta,e)\,\psi'(\theta)}{\gamma\left[\varphi(\theta,e)\,\psi(\theta) - (1-\gamma)\,\kappa\right]}\frac{\partial\varphi}{\partial e}, \tag{18}$$

then, the direct effect of a male's education on the age of his bride at marriage is strictly

positive.

Proposition 4.1 states that the mechanism underlying the direct effect of a male's education on the age of his bride at marriage works through the complementarity between maternal and paternal education in the production of child quality. Indeed, condition (18) states that the complementarity between parental and maternal education in the production of child quality is sufficiently strong. When this condition holds, males with low levels of education will most likely choose younger (less educated) brides. From a public policy perspective, this proposition suggests that public policy targeting boys in their formative years, for example, through improved access to education, may represent a promising long-term avenue for reducing the incidence of underage marriage.

5 Empirical Evidence in Support of the Mechanism

This section provides empirical evidence in support of the mechanism underlying the effect of education on a prospective groom's net payoff from marriage with an underage girl as outlined in the theoretical model. Just to recall, in the theoretical model, marriage is entered into for the sole purpose of reproduction– an activity that generates a surplus to both spouses. In keeping up with the existing literature, this surplus is modelled as a Cobb-Douglas function of the quantity and quality of offspring, both of which are costly to produce. Furthermore, again, in line with the existing literature, we model maternal and paternal education as inputs in the production of child quality. In that context, we show that the mechanism that matches prospective grooms with low levels of education to underage girls as potential spouses works through the relatively high (respectively, low) cost of quality (respectively, quantity) such a match entails. Indeed, given that there exists a quantity-quality trade-off, and to the extent that paternal education and maternal education are complementary in the production of child quality, a marital match between a less educated male and an underage girl yields higher quantity, but low-quality, offspring. We test this mechanism in two parts. First, we test whether a household in which the husband and the wife have low levels of education has more children than one in which the husband and the wife have higher levels

of education (Claim 4.1). Second, we test whether a household in which the husband and the wife have low levels of education has lower quality children than one in which the husband and the wife have higher levels of education (Claim 4.2).

To test the first part of the mechanism, we use an OLS regression to estimate the interaction effects of a husband and his wife levels of education on the number of children they have (equation (19)). In equation (19), n_i denotes couple i's total number of children ever born, $E1_i$ denotes the level of education of the husband and $E2_i$ his wife's level of education:

$$n_i = \beta_0 + \beta_1(E1_i \times E2_i) + \epsilon_i. \tag{19}$$

We restrict the sample to couples in which the wife is aged $40 - 49$, because they are the most likely to have already completed their fertility. Estimates of the interaction effects of husband level of education and his wife's age at first marriage on their number of children are reported in Column (I) of Table 8. All estimates are negative and statistically significant, indicating that a household in which the husband and the wife have higher levels of education has less children than one in which the husband and the wife have low levels of education. When we do not include any control, we find that a couple in which both spouses have primary education has on average 1.1 children less compared to one in which spouses have no education (Column I). Similarly, a couple in which the husband and the wife both have secondary education has on average 2.4 children less compared to one in which both have no education (Column I).

To test the second part of the mechanism, we use an OLS regression to estimate the interaction effects of a husband's and his wife's levels of education on their child quality (equation (20)). In equation (20), q_{ifm} denotes the quality of child i (measured by her/his level of educational attainment), born to father f and mother m; E_f denotes the level of education of her/his father and E_m denotes the level of education of her/his mother:

$$q_{ifm} = \beta_0 + \beta_1(E_f \times E_m) + \epsilon_i. \tag{20}$$

The test is performed by restricting the sample to children aged 17-18. Results are reported in Table 8, Column (II). We find that all estimates are positive and statistically significant, indicating that a household in which both spouses have higher levels of education has more educated children than the one in which the husband and the wife have low levels of education. For instance, when we do not include any control, we find that a household in which the husband and the wife both have primary education is associated with 4.6 extra years of child's schooling on average compared to the one in which they both have no education (Column II). Similarly, a household in which the husband and the wife both have secondary education is associated with 5.8 extra years of child's schooling on average compared to one in which both have no education. We check the robustness of this mechanism by restricting the sample to children aged 18 in Column (III). We find larger effects that are all statistically significant.

These results are corroborated by an additional analysis showing that the interacting effect of a father's education and whether the mother was an underage bride is negative for the number of children and positive for the quality of children (Table 9). Overall, these findings follow from the fact that marriage involving an underage girl lead to larger quantity and less quality of offspring.

6 Conclusion

Public policy addressing the issue of underage marriage has primarily emphasized public investment in girls' education and the prescription of age-of-consent laws for marriage. While the focus on girls' agency is intuitively compelling, it remains that in patriarchal societies, such supply-side policies may yield a low payoff if they ignore the role men play as prospective grooms, fathers, public officials, and community leaders, wielding a tremendous amount of decision-making power over many aspects of females' lives. To our knowledge, this paper is the first to systematically explore the role men, as husband, play in driving down underage marriage. Specifically, we analyze the effect of a male's education on the likelihood that he marries an underage girl, and explores spatial sources of heterogeneity in this effect.

Using micro-level data from Nigeria, we find that a male's education negatively affects the probability that he marries an underage girl. We provide evidence that this effect is causal. It is not a mere mechanical effect reflecting the endogeneity between schooling and marriage-timing decisions. Moreover, sensitivity analyses reveal that this effect is stronger in urban areas and in Southern Nigeria, suggesting that male education matters more in areas where cultural norms that cast women and girls in submissive roles are weaker.

We develop a theoretical model to explain the negative effect a male's level of education has on the age of his bride at marriage. We show that the strategic complementarity between paternal and maternal education in the production of child quality is an important element in this explanation. When this strategic complementary is sufficiently strong, it combines with the quantity-quality trade-off characterizing parental investment in children to create a positive assortative mating based on spousal education.

We provide empirical evidence in support of this theoretical mechanism. In particular, we find that the interacting effect of the father's and the mother's education is negative for the number of children they have, and positive for the level of education of these children. The implication, which follows from the model, is that grooms with less education are most likely to marry underage girls.

From a public policy point of view, this research provides evidence that not including boys and men in interventions aimed at eliminating underage marriage may yield a low payoff. In combination with the large literature showing that public investment in girls' education matters for the elimination of underage marriage, our paper can be taken to suggest that public policy that also targets boys in their formative years can enhance the fight against this harmful practice.

References

Ahmed, A. and C. del Ninno (2002): "The Food For Education Program in Bangladesh," FCND briefs 138, International Food Policy Research Institute (IFPRI).

Akerlof, G. (1976): "The Economics of Caste and of the Rat Race and other Woeful Tales," *The Quarterly Journal of Economics*, 599–617.

Anderson, S. (2007): "The Economics of Dowry and Brideprice," *Journal of Economic Perspectives*, 21, 151–174.

Angrist, J. (2002): "How Do Sex Ratios Affect Marriage and Labor Markets? Evidence from America's Second Generation," *The Quarterly Journal of Economics*, 117, 997–1038.

Angrist, J. D. and V. Lavy (1996): "The Effect of Teen Childbearing and Single Parenthood on Childhood Disabilities and Progress in School," Tech. rep., National Bureau of Economic Research.

Ashraf, N., E. Field, and J. Lee (2014): "Household Bargaining and Excess Fertility: An Experimental Study in Zambia," *The American Economic Review*, 104, 2210–2237.

Becker, G. S. (1981): "Altruism in the Family and Selfishness in the Market Place," *Economica*, 48, 1–15.

Becker, G. S. and H. G. Lewis (1973): "On the Interaction between the Quantity and Quality of Children," *Journal of Political Economy*, 81, S279–S288.

Becker, G. S., K. M. Murphy, and R. Tamura (1990): "Human Capital, Fertility, and Economic Growth," *Journal of Political Economy*, 98, S12–37.

Borjas, G. J. (1992): "Ethnic Capital and Intergenerational Mobility," *The Quarterly Journal of Economics*, 107, 123–150.

Buckles, K. (2008): "Understanding the Returns to Delayed Childbearing for Working Women," *The American Economic Review*, 98, 403–07.

Budig, M. J. and P. England (2001): "The Wage Penalty for Motherhood," *American Sociological Review*, 204–225.

Card, D. (2001): "Estimating the Return to Schooling: Progress on some Persistent Econometric Problems," *Econometrica*, 69, 1127–1160.

Chevalier, A., C. Harmon, V. O'Sullivan, and I. Walker (2013): "The Impact of Parental Income and Education on the Schooling of Children," Papers WP468, Economic and Social Research Institute (ESRI).

Chowdhury, A. and M. M. Patnaik (2010): "Empowering Boys and Men to Achieve Gender Equality in India," *Journal of Developing Societies*, 26, 455–471.

De La Croix, D. and M. Doepke (2003): "Inequality and Growth: Why Differential Fertility Matters," *The American Economic Review*, 93, 1091–1113.

Dev, P., B. U. Mberu, and R. Pongou (2016): "Ethnic Inequality: Theory and Evidence from Formal Education in Nigeria," *Economic Development and Cultural Change*, 64, 603–660.

Doss, C. (2013): "Intrahousehold Bargaining and Resource Allocation in Developing Countries," Policy Research Working Paper Series 6337, The World Bank.

Duflo, E., P. Dupas, and M. Kremer (2015): "Education, HIV, and Early Fertility: Experimental Evidence from Kenya," *The American Economic Review*, 105, 2757–2797.

Duncan, G. J., K. T. Lee, M. Rosales-Rueda, K. Ariel, and K. Ziol-Guest (2015): "Maternal Age and Child Achievement," Tech. rep.

Dyer, S., N. Abrahams, N. Mokoena, and Z. van der Spuy (2004): "'You are a Man Because you Have Children': Experiences, Reproductive Health Knowledge and Treatment-seeking Behaviour among Men Suffering from Couple Infertility in South Africa," *Human Reproduction*, 19, 960–967.

Farré, L. (2011): "The Role of Men for Gender Equality," Tech. rep., World Development Report 2012.

Farré, L. and F. Vella (2013): "The Intergenerational Transmission of Gender Role Attitudes and its Implications for Female Labour Force Participation," *Economica*, 80, 219–247.

Field, E. and A. Ambrus (2008): "Early Marriage, Age of Menarche, and Female Schooling Attainment in Bangladesh," *Journal of Political Economy*, 116, 881–930.

Herbers, J. E., J. Cutuli, T. L. Lafavor, D. Vrieze, C. Leibel, J. Obradović, and A. S. Masten (2011): "Direct and Indirect Effects of Parenting on the Academic Functioning of Young Homeless Children," *Early Education & Development*, 22, 77–104.

Hoddinott, J. (1992): "Rotten Kids or Manipulative Parents: Are Children Old Age Security in Western Kenya?" *Economic Development and Cultural Change*, 40, 545–565.

Horowitz, D. L. (1985): *Ethnic Groups in Conflict*, Univ of California Press.

Jacoby, H. G. and G. Mansuri (2010): ""Watta Satta": Bride Exchange and Women's Welfare in Rural Pakistan," *The American Economic Review*, 100, 1804–1825.

Jayachandran, S. (2015): "The Roots of Gender Inequality in Developing Countries," *Annual Review of Economics*, 7, 63–88.

Jensen, R. and R. Thornton (2003): "Early Female Marriage in the Developing World," *Gender & Development*, 11, 9–19.

Jones, N., B. Tefera, J. Stephenson, T. Gupta, and P. Pereznieto (2014): "Early Marriage and Education: the Complex Role of Social Norms in Shaping Ethiopian Adolescent Girls' Lives," .

Lambert, S. and P. Rossi (2016): "Sons as Widowhood Insurance: Evidence from Senegal," *Journal of Development Economics*, 120, 113 – 127.

Leigh, A. and X. Gong (2010): "Does Maternal Age Affect Children's Test Scores?" *Australian Economic Review*, 43, 12–27.

Malhotra, A., R. Pande, and C. Grown (2003): "Impact of Investments in Female Education on Gender Equality," *International Center for Research on Women*, 35.

Marteleto, L. J. and M. Dondero (2013): "Maternal Age at First Birth and Adolescent Education in Brazil," *Demographic Research*, 28, 793–820.

Oliveira, J. (2016): "The Value of Children: Inter-generational Support, Fertility, and Human Capital," *Journal of Development Economics*, 120, 1–16.

Pongou, R. and R. Serrano (2016): "Volume of Trade and Dynamic Network Formation in Two-sided Economies," *Journal of Mathematical Economics*, 63, 147–163.

Ringheim, K. and C. Feldman-Jacobs (2009): "Engaging Men for Gender Equality and Improved Reproductive Health," *Washington DC Population Reference Bureau [PRB]*.

Serafino, P. and R. Tonkin (2014): "Intergenerational Predictors Of Poverty in the UK and EU," in *IARIW Conference, the Netherlands*.

Serra, R. (2009): "Child Fostering in Africa: When Labor and Schooling Motives may Coexist," *Journal of Development Economics*, 88, 157–170.

Stephenson, R., A. Baschieri, S. Clements, M. Hennink, and N. Madise (2007): "Contextual Influences on Modern Contraceptive Use in Sub-Saharan Africa," *American Journal of Public Health*, 97, 1233–1240.

Thomas, D., J. Strauss, and M.-H. Henriques (1991): "How Does Mother's Education Affect Child Height?" *Journal of Human Resources*, 26, 183–211.

UNICEF (2014): "Ending Child Marriage: Progress and Prospects," *New York: UNICEF*.

——— (2016): "The State of the World's Children 2016: A fair Chance for Every Child," Report, UNICEF.

Vogelstein, R. (2013): *Ending Child Marriage: How Elevating the Status of Girls Advances U.S. Foreign Policy Objectives*, Council on Foreign Relations.

Vogl, T. S. (2016): "Differential Fertility, Human Capital, and Development," *The Review of Economic Studies*, 83, 365–401.

Wantchekon, L., M. Klašnja, and N. Novta (2015): "Education and Human Capital Externalities: Evidence from Colonial Benin," *The Quarterly Journal of Economics*, 130, 703–757.

Wilde, E. T., L. Batchelder, and D. T. Ellwood (2010): "The Mommy Track Divides: The Impact of Childbearing on Wages of Women of Differing Skill Levels," Working Paper 16582, National Bureau of Economic Research.

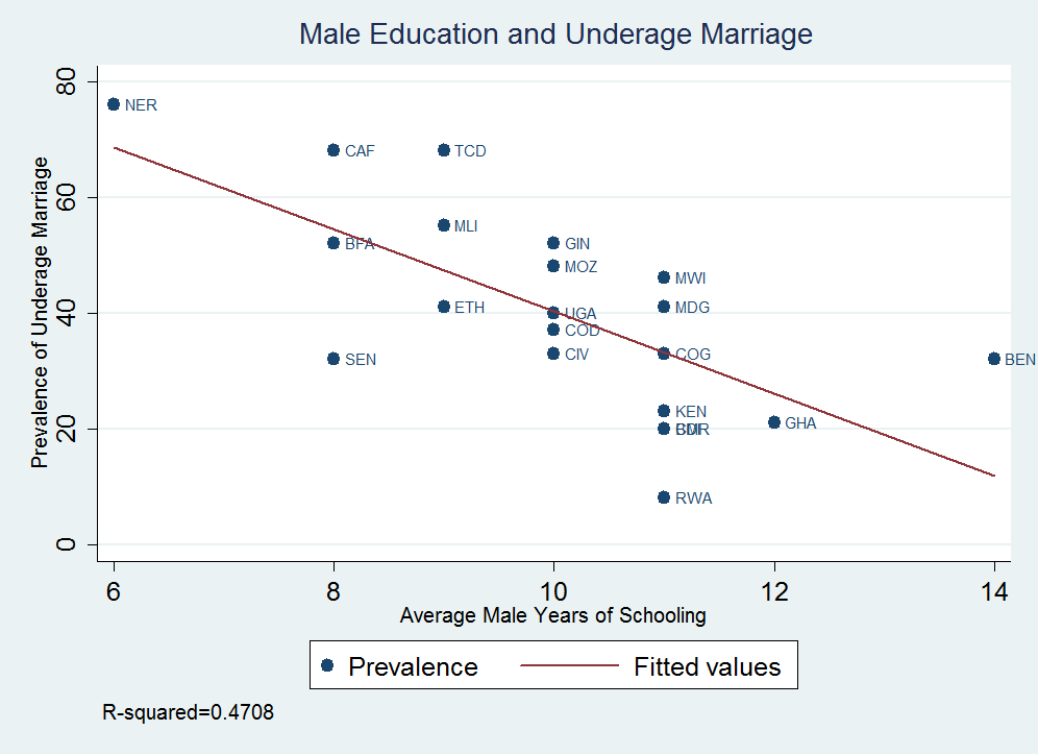

Figure 1: Relationship between male education and the prevalence of underage marriage

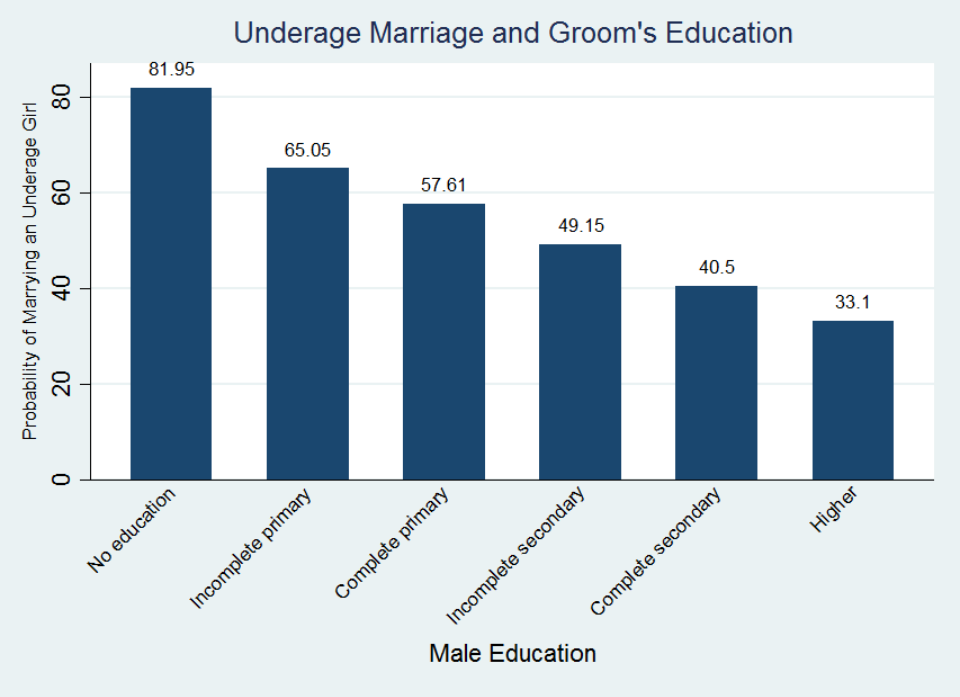

Figure 2: Probability of marrying an underage girl by educational level in Nigeria

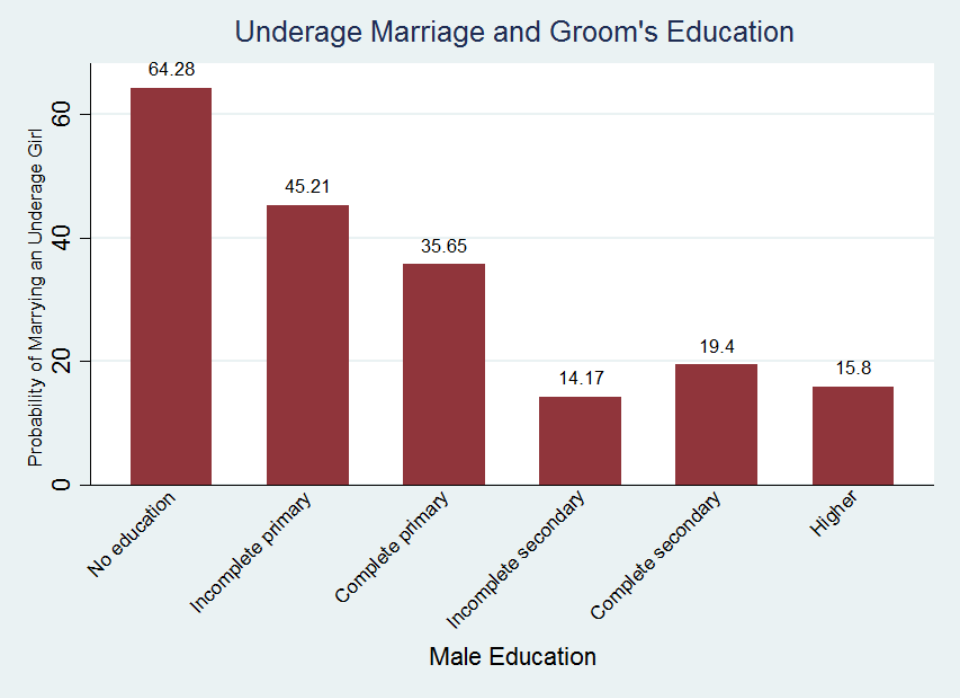

Figure 3: Probability of marrying an underage girl by education for men whose age at marriage was 30 or higher in Nigeria

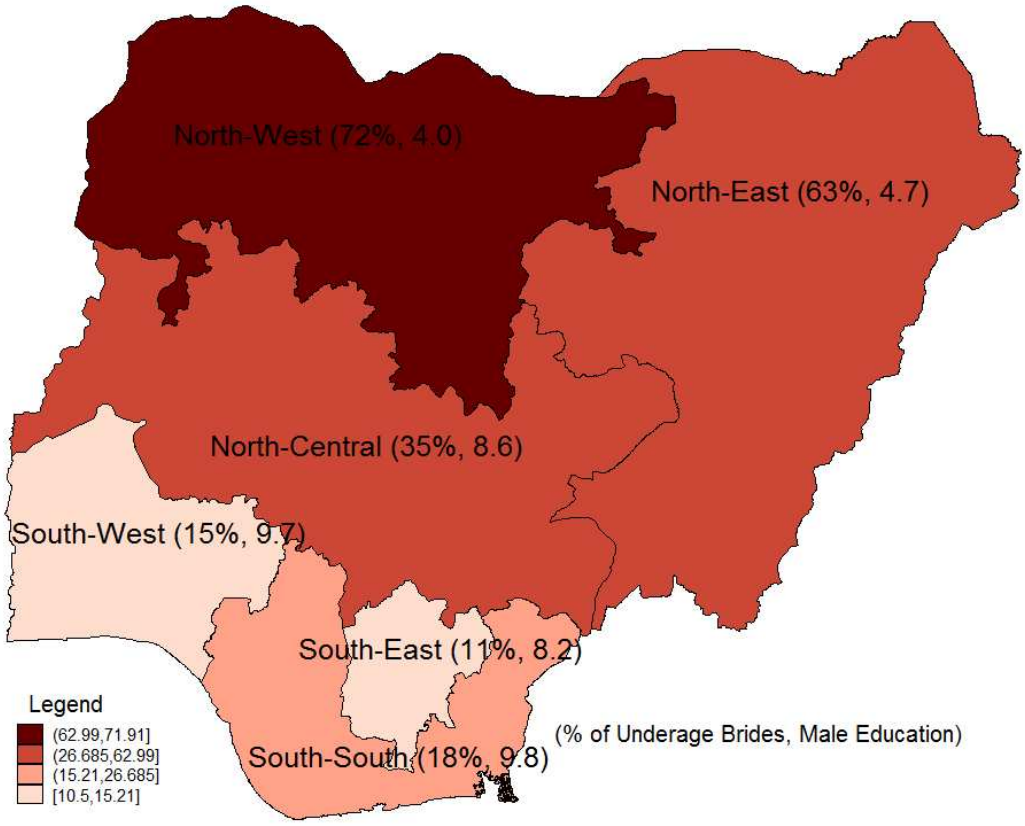

Figure 4: Geographic distribution of prevalence of underage brides and average number of years of schooling for males in Nigeria
Note: Darker color indicates a higher prevalence of underage marriage.

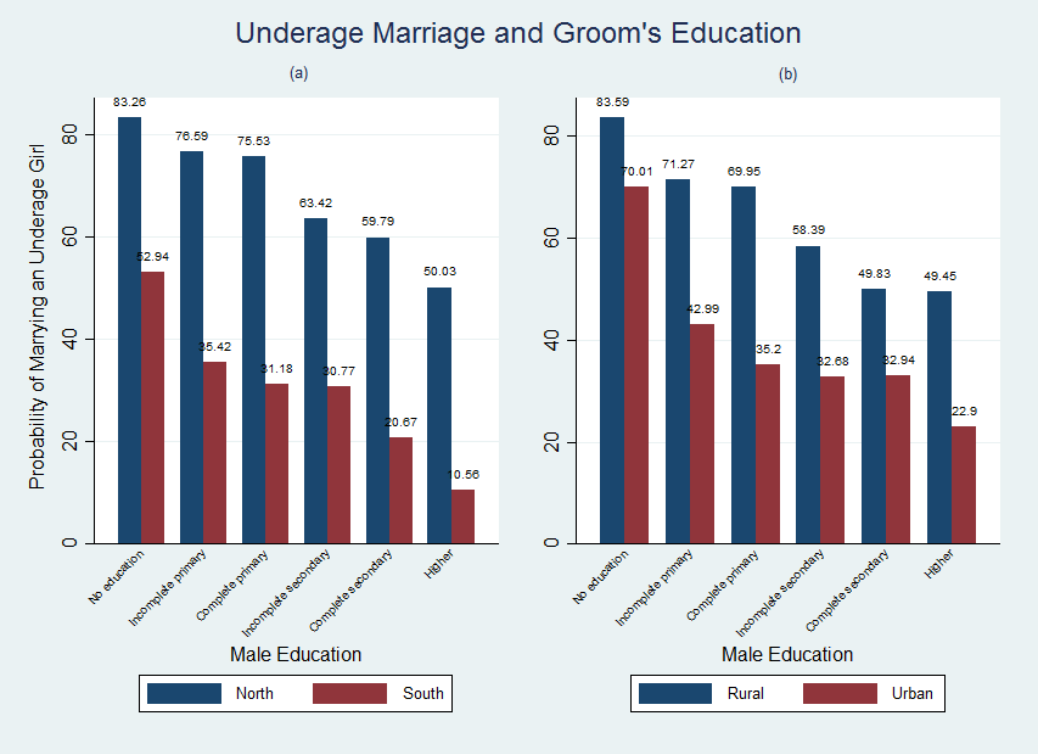

Figure 5: Probability of marrying an underage girl by region (North vs. South) and by rural/urban place of residence in Nigeria

Table 1: Summary Statistics

Males' Characteristics		
Variables	Mean	SD
Probability of marrying an underage girl	0.59	0.492
Education		
Average years of schooling	6.65	5.739
Religion		
Christian	34.98	0.477
Muslim	63.19	0.482
Other religion	1.83	0.134
Region		
North	71.10	0.453
South	28.90	0.453
Place of residence		
Urban	34.19	0.474
Rural	65.81	0.474
Other characteristics		
Proportion of older co-ethnics who married underage girls	0.61	0.309
Age at frst marriage	24.86	5.421
Current age	36.79	7.393
Sex ratio	1.06	0.423
Profession		
Agriculture	38.65	0.487
Unskilled worker	23.17	0.422
Skilled worker	25.22	0.434
Professional worker	12.97	0.336

Table 2: OLS Estimation of the Effect of Male Education on the Demand for Underage Brides

	Dependent Variable is Bride Type (0/1)				
Variable	(I)	(II)	(III)	(IV)	(V)
Education: in single years	-0.034***	-0.016***	-0.013***	-0.010***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Muslim		0.179***	0.123***	0.118***	0.116***
		(0.014)	(0.014)	(0.014)	(0.014)
Living in northern region		0.199***	0.115***	0.107***	0.106***
		(0.015)	(0.016)	(0.015)	(0.015)
Living in rural area		0.162***	0.112***	0.082***	0.081***
		(0.012)	(0.012)	(0.012)	(0.012)
Prop. of ado. marr. in older co-ethnics			0.381***	0.352***	0.351***
			(0.022)	(0.021)	(0.021)
Age at first marriage				-0.020***	-0.020***
				(0.001)	(0.001)
Current age				0.003***	0.003***
				(0.001)	(0.001)
Sex ratio					0.016
					(0.011)
Unskilled worker					0.013
					(0.012)
Skilled worker					-0.015
					(0.013)
Professional worker					-0.026
					(0.018)
Constant	0.809***	0.320***	0.215***	0.630***	0.609***
	(0.007)	(0.015)	(0.017)	(0.034)	(0.037)
N. obs	8394	8394	8054	8054	7945
R-squared	0.153	0.268	0.295	0.335	0.335

Heteroskedasticity-robust standard errors are in parentheses.
* p<.1; ** p<.05; *** p<.01.

Table 3: IV Estimation of the Effect of Male Education on the Demand for Underage Brides

Second-Stage Regressions: Dependent Variable is Bride Type (0/1)			
	(I) D-ethnic IV	(II) Co-ethnic IV	(III) Both IVs
Education	-0.038***	-0.026***	-0.035***
	(0.009)	(0.003)	(0.005)
Muslim	0.060*	0.066***	0.070***
	(0.031)	(0.017)	(0.024)
Living in northern region	0.128***	0.102***	0.128***
	(0.023)	(0.016)	(0.022)
Living in rural area	0.076***	0.060***	0.080***
	(0.023)	(0.013)	(0.021)
Prop. of ado. marr. in older co-ethnics	0.180***	0.307***	0.192***
	(0.044)	(0.023)	(0.036)
Age at first marriage	-0.016***	-0.018***	-0.017***
	(0.002)	(0.001)	(0.002)
Current age	0.003**	0.002***	0.003***
	(0.001)	(0.001)	(0.001)
Sex ratio	-0.017	0.012	-0.015
	(0.016)	(0.011)	(0.016)
Unskilled worker: ref. agriculture	0.080***	0.040***	0.072***
	(0.030)	(0.013)	(0.023)
Skilled worker	0.051	0.023	0.041
	(0.034)	(0.015)	(0.025)
Professional worker	0.164**	0.088***	0.138***
	(0.071)	(0.028)	(0.045)
Constant	0.819***	0.751***	0.792***
	(0.087)	(0.046)	(0.066)
N. obs	3340	7945	3340
R-squared	0.322	0.316	0.334
Haussman test: statistic (p-value)	20.04 (0.000)	92.72 (0.000)	57.21 (0.000)
Sargan-Hansen test:	-	-	0.019 (0.9)
Weak ident. test (Cragg-Donald Wald F statistic):	202.208	1223.989	283.872
Stock-Yogo weak ID test critical values:			
5% maximal IV relative bias	16.38	16.38	19.93
10% maximal IV relative bias	8.96	8.96	11.59
20% maximal IV relative bias	6.66	6.66	8.75
30% maximal IV relative bias	5.53	5.53	7.25

Notes: Heteroskedasticity-robust standard errors and p-values for Haussman and Sargan tests are in parentheses. Column (I) (also called D-ethnic IV) estimates the effect of male education on the demand for underage brides using the average education of older (5 years and higher) males from other ethnic groups as an instrument. In Column (II) (also called Co-ethnic IV), the average education of older (5 years and higher) male co-ethnics is used as an instrument for male education. In Column (III) (also called Both IVs), both instruments are used. p<.1; ** p<.05; *** p<.01.

Table 4: IV First-Stage Regressions

Dependent Variable is Male's Years of Education			
Variable	(I)	(II)	(III)
	D-ethnic IV	Co-ethnic IV	Both IVs
Av. level of education (Other ethnic groups)	0.229***	-	0.079***
	(0.020)		(0.021)
Av. level of education (Co-ethnics)	-	0.502***	0.421***
		(0.015)	(0.025)
Muslim	-2.083***	-1.675***	-1.317***
	(0.199)	(0.128)	(0.196)
Living in northern region	0.225	-0.008	0.210
	(0.213)	(0.138)	(0.204)
Living in rural area	-0.651***	-0.370***	-0.134
	(0.189)	(0.117)	(0.184)
Prop. of ado. marr. in older co-ethnics	-2.527***	-0.570***	-1.003***
	(0.302)	(0.206)	(0.304)
Age at first marriage	0.116***	0.088***	0.105***
	(0.015)	(0.009)	(0.015)
Current age	-0.014	-0.013**	-0.004
	(0.011)	(0.007)	(0.011)
Sex ratio	-0.458***	-0.159	-0.289*
	(0.161)	(0.115)	(0.155)
Unskilled worker: ref. agriculture	2.121***	1.150***	1.675***
	(0.202)	(0.124)	(0.196)
Skilled worker	2.457***	1.469***	1.835***
	(0.204)	(0.125)	(0.199)
Professional worker	6.444***	5.771***	5.611***
	(0.256)	(0.157)	(0.251)
N. obs	3337	7938	3337
R-squared	0.503	0.508	0.542

Notes: Heteroskedasticity-robust standard errors are in parentheses. Column (I) (also called D-ethnic IV) estimates the effect of the average education of older (5 years and higher) males from other ethnic groups on a male's education. Column (II) (also called Co-ethnic IV) estimates the effect of the average education of older (5 years and higher) male co-ethnics on a male's education. Column (III) (also called Both IVs) estimates the effects of both instrumental variables. * p<.1; ** p<.05; *** p<.01.

Table 5: **Robustness Checks**: OLS and IV Estimations of the Effect of Male Education on the Demand for Underage Brides for Males Aged 30 or Higher at the Time of Marriage

	OLS	**IV**		
	(I)	(II)	(III)	(IV)
Variable		D-ethnic IV	Co-ethnic IV	Both IVs
Education	-0.013***	-0.040**	-0.030***	-0.045***
	(0.003)	(0.016)	(0.007)	(0.011)
Muslim	0.151***	0.079	0.100***	0.062
	(0.028)	(0.060)	(0.032)	(0.049)
Living in northern region	0.132***	0.128***	0.135***	0.131***
	(0.027)	(0.037)	(0.028)	(0.036)
Living in rural area	0.105***	0.086*	0.074***	0.075*
	(0.024)	(0.049)	(0.027)	(0.045)
Prop. of AM in older co-ethnics	0.256***	0.119*	0.220***	0.105*
	(0.040)	(0.072)	(0.042)	(0.062)
Current age	0.008***	0.010***	0.006***	0.009***
	(0.002)	(0.003)	(0.002)	(0.003)
Sex ratio	-0.005	-0.043	-0.002	-0.043
	(0.024)	(0.030)	(0.024)	(0.031)
Unskilled worker: ref. agriculture	0.019	0.137**	0.045	0.145***
	(0.033)	(0.057)	(0.035)	(0.055)
Skilled worker	-0.036	0.081	0.000	0.091*
	(0.030)	(0.060)	(0.035)	(0.055)
Professional worker	-0.014	0.200*	0.103*	0.234**
	(0.036)	(0.120)	(0.059)	(0.094)
Constant	-0.182*	0.042	0.047	0.110
	(0.093)	(0.243)	(0.127)	(0.195)
N. obs	1466	680	1466	680
R-squared	0.327	0.325	0.303	0.304
Sargan-Hansen test: stat. (p-value)	-	-	-	0.231 (0.631)

Notes: Heteroskedasticity-robust standard errors and p-values for the Sargan-Hansen test are in parentheses. Column (II) (also called D-ethnic IV) estimates the effect of male education on the demand for underage brides using the average education of older (5 years and higher) males from other ethnic groups as an instrument. In Column (III) (also called Co-ethnic IV), the average education of older (5 years and higher) male co-ethnics is used as an instrument for male education. In Column (IV) (also called Both IVs), both instruments are used. p<.1; ** p<.05; *** p<.01.

Table 6: OLS and IV Estimations of the Effect of Male Education on the Demand for Underage Brides by Region (North vs. South)

	Estimation Strategy: OLS		
	(I)	(II)	(III)
		North	
Education: in single years	-0.025***	-0.019***	-0.009***
	(0.001)	(0.001)	(0.001)
Muslim	-	0.227***	0.147***
		(0.016)	(0.017)
N. obs	5824	5824	5579
R-squared	0.098	0.135	0.229
		South	
Education: in single years	-0.020***	-0.020***	-0.007***
	(0.002)	(0.002)	(0.002)
Muslim	-	-0.027	-0.022
		(0.024)	(0.024)
N. obs	2570	2570	2366
R-squared	0.035	0.035	0.167
All Baseline Controls	No	No	Yes
	Estimation Strategy: IV		
	D-ethnic IV	Co-ethnic IV	Both IVs
		North	
Education: in single years	-0.031***	-0.024***	-0.026***
	(0.011)	(0.004)	(0.006)
Muslim	0.123***	0.094***	0.135***
	(0.041)	(0.021)	(0.031)
N. obs	2313	5579	2313
R-squared	0.239	0.207	0.254
Sargan-Hansen test: stat. (p-value)	-	-	0.101 (0.750)
		South	
Education: in single years	-0.072*	-0.017**	-0.051***
	(0.037)	(0.160)	(0.013)
Muslim	-0.089	-0.035	-0.061
	(0.060)	(0.025)	(0.038)
N. obs	1027	2366	1027
R-squared	-0.065	0.160	0.089
Sargan-Hansen test: stat. (p-value)	-	-	0.479 (0.489)
All Baseline Controls	Yes	Yes	Yes

Notes: Heteroskedasticity-robust standard errors and p-values for the Sargan-Hansen test are in parentheses. Baseline controls include: religious affiliation, region of residence (North vs. South), area of residence (rural vs. urban), the proportion of older co-ethnics who married underage girls, a male's current age and his age at first marriage, the sex ratio, and professional activities. * p<.1; ** p<.05; *** p<.01.

Table 7: OLS and IV Estimations of the Effect of Male Education on the Demand for Underage Brides by Urban/Rural Place of Residence

	Estimation Strategy: OLS		
	(I)	(II)	(III)
		Urban	
Education: in single years	-0.026***	-0.020***	-0.008***
	(0.002)	(0.002)	(0.002)
Muslim	-	0.249***	0.072***
		(0.018)	(0.021)
N. obs	2718	2718	2486
R-squared	0.075	0.139	0.288
		Rural	
Education: in single years	-0.028***	-0.015***	-0.010***
	(0.001)	(0.001)	(0.001)
Muslim	-	0.301***	0.143***
		(0.015)	(0.019)
N. obs	5676	5676	5459
R-squared	0.107	0.180	0.259
All Baseline Controls	No	No	Yes
	Estimation Strategy: IV		
	D-ethnic IV	Co-ethnic IV	Both IVs
		Urban	
Education: in single years	-0.049***	-0.041***	-0.043***
	(0.016)	(0.007)	(0.009)
Muslim	0.006	0.017	0.018
	(0.040)	(0.024)	(0.031)
N. obs	1328	2486	1328
R-squared	0.176	0.200	0.208
Sargan-Hansen test: stat. (p-value)	-	-	0.111 (0.739)
		Rural	
Education: in single years	-0.033***	-0.019***	-0.030***
	(0.012)	(0.004)	(0.006)
Muslim	0.124**	0.109***	0.131***
	(0.048)	(0.023)	(0.037)
N. obs	2012	5459	2012
R-squared	0.226	0.252	0.235
Sargan-Hansen test: stat. (p-value)	-	-	0.479 (0.489)
All Baseline Controls	Yes	Yes	Yes

Notes: Heteroskedasticity-robust standard errors and p-values for the Sargan-Hansen test are in parentheses. Baseline controls include: religious affiliation, region of residence (North vs. South), area of residence (rural vs. urban), the proportion of older co-ethnics who married underage girls, a male's current age and his age at first marriage, the sex ratio, and professional activities. * p<.1; ** p<.05; *** p<.01.

Table 8: Interaction Effects of Father's and Mother's Education on Quantity and Quality of Children

	Child Quantity	**Child Quality: Education**	
	(I)	**(II)**	**(III)**
	N. of children	Child educ. (17-18)	Child educ. (18)
Father educ*Mother educ	Coef.	Coef.	Coef.
No education*No education: Ref			
No education*Primary	-0.327**	2.487***	2.140***
	(0.163)	(0.397)	(0.602)
No education*Secondary	-1.620***	5.403***	5.474***
	(0.299)	(0.714)	(0.996)
No education*Higher	-2.226*	-	-
	(1.233)		
Primary*No education	-0.378**	3.328***	3.486***
	(0.149)	(0.340)	(0.464)
Primary*Primary	-1.111***	4.563***	4.591***
	(0.111)	(0.277)	(0.401)
Primary*Secondary	-2.117***	6.206***	6.262***
	(0.159)	(0.395)	(0.575)
Primary*Higher	-3.184***	6.338***	6.000***
	(0.354)	(0.799)	(1.035)
Secondary*No education	-0.615***	3.893***	3.244***
	(0.197)	(0.503)	(0.716)
Secondary*Primary	-1.469***	5.193***	5.146***
	(0.136)	(0.368)	(0.542)
Secondary*Secondary	-2.412***	5.815***	5.601***
	(0.122)	(0.317)	(0.446)
Secondary*Higher	-3.158***	6.720***	6.381***
	(0.266)	(0.641)	(0.961)
Higher*No education	-0.272	5.181***	4.381***
	(0.261)	(0.588)	(0.961)
Higher*Primary	-0.719***	5.503***	5.667***
	(0.212)	(0.463)	(0.633)
Higher*Secondary	-2.340***	6.209***	6.024***
	(0.163)	(0.404)	(0.625)
Higher*Higher	-3.227***	6.722***	6.779***
	(0.144)	(0.389)	(0.537)
N. obs	7075	1796	923
R-squared	0.135	0.372	0.358

Notes: Heteroskedasticity-robust standard errors are in parentheses.
* p<.1; ** p<.05; *** p<.01.

Table 9: Interaction Effects of Father's Education and Mother's Early Marriage on Quantity and Quality of Children

	Child Quantity	**Child Quality: Education**	
	(I)	**(II)**	**(III)**
Variables	N. of children	Child educ. (17-18)	Child educ. (18)
Father educ*Bride type	Coef.	Coef.	Coef.
No education*UnderageBride: Ref			
No education*AdultBride	-1.682***	0.928***	1.144***
	(0.109)	(0.284)	(0.390)
Primary*UnderageBride	-0.797***	4.159***	4.314***
	(0.115)	(0.290)	(0.398)
Primary*AdultBride	-2.353***	4.734***	4.989***
	(0.109)	(0.282)	(0.414)
Secondary*UnderageBride	-1.257***	4.969***	4.753***
	(0.131)	(0.373)	(0.518)
Secondary*AdultBride	-2.901***	5.418***	5.455***
	(0.107)	(0.285)	(0.414)
Higher*UnderageBride	-0.877***	5.497***	5.545***
	(0.155)	(0.370)	(0.546)
Higher*AdultBride	-3.478***	6.210***	6.348***
	(0.118)	(0.322)	(0.458)
N. obs	7075	1796	923
R-squared	0.168	0.327	0.319

Notes: Heteroskedasticity-robust standard errors are in parentheses. The variable UnderageBride is a binary indicator for whether the mother was less than 18 years old when she got married. The variable AdultBride is a binary indicator for whether the mother was at least 18 years old when she got married. * p<.1; ** p<.05; *** p<.01.